Chapter 510 Toll Plaza

510.01 General

Toll plazas are utilized at many WSF terminals to collect fares for vehicles and their passengers before entering the vehicle holding area. Toll plazas need also accommodate foot passenger ticket sales at terminals where there is not an operating ticket sales counter within the terminal building year round. There currently are no toll booths at Friday Harbor, Lopez, Shaw, Tahlequah and Vashon Ferry Terminals, therefore guidance for toll plazas does not apply to these terminals.

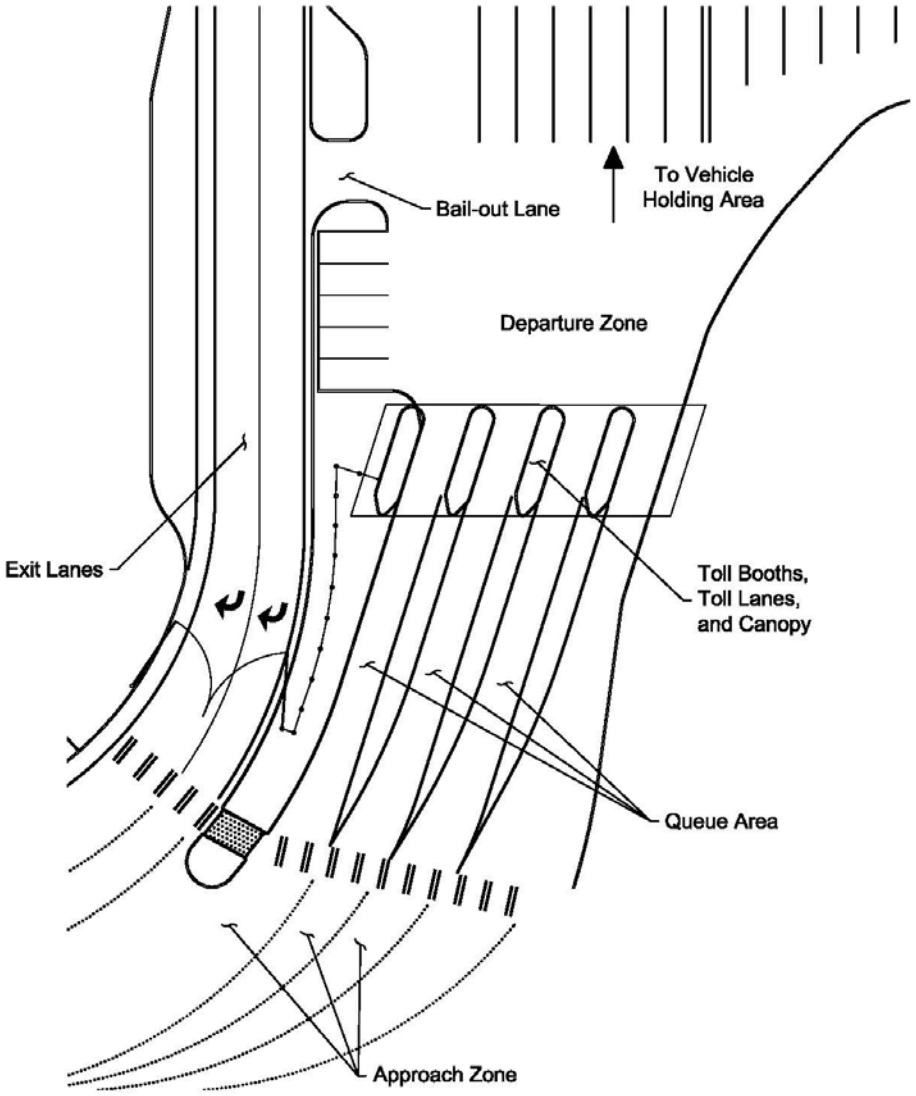
The toll plaza consists of an approach zone, queue area, toll lanes, the toll island, a departure zone, a bail-out lane and, in some cases, a terminal supervisor office (see Chapter 500 for requirements). The toll plaza accommodates pre-ticketing space and required turning movements for vehicles to access the toll booths. Exhibit 510-1 shows the toll plaza for the Seattle Ferry Terminal.

WSF provides priority access for certain vehicles that qualify for preferential loading. Refer to Chapter 520 (Vehicle Holding and Support Areas) for discussion of priority vehicles.

Seattle Ferry Terminal Toll Plaza
Exhibit 510-1

For additional information, see the following chapters:

Chapter	Subject
300	Accessibility
310	Security
320	Environmental Considerations
340	Civil
350	Buildings
360	Electrical
430	Terminal Supervisor Buildings
520	Vehicle Holding and Support Areas
570	Signage and Wayfinding



Example Toll Plaza Layout
Exhibit 510-2

510.02 References

Unless otherwise noted, any code, standard, or other publication referenced herein refers to the latest edition of said document.

(1) Federal/State Laws and Codes

ADA (28 CFR Part 35), Department of Justice

Revised Code of Washington (RCW) 47.60.550, Parking or holding area for ferry patrons in conjunction with municipal off-street parking facilities.

RCW 90.58, Shoreline Mangement Act of 1971

Washington Administrative Code (WAC) 468-300-700, Preferential Loading

WAC 468-300-100, Leases of Facilities and Facility Space

(2) Design Guidance

Standard Plans for Road, Bridge, and Municipal Construction (Standard Plans), M21-01, WSDOT

Traffic Manual, M51-02, WSDOT

Design Manual, M22-01, WSDOT

Reference Drawings, WSF

(3) Supporting Information

State of the Practice and Recommendations of Traffic Control Strategies at Toll Plazas, FHWA 2006.

*WSDOT Ferries Division Final Long-Range Plan (*Long Range Plan*)*, WSDOT, 2009.

WSF Traffic Statistics, WSDOT.

510.03 Design Considerations

(1) Accessibility

Wherever pedestrian facilities are intended to be a part of a transportation facility, 28 CFR Part 35 requires that those pedestrian facilities meet ADA guidelines. Federal regulations require that all new construction, reconstruction, or alteration of existing transportation facilities be designed and constructed to be accessible and useable by those with disabilities and that existing facilities be retrofitted to be accessible. Design pedestrian facilities to accommodate all types of pedestrians, including children, adults, the elderly, and persons with mobility, sensory, or cognitive disabilities. Refer to Chapter 300 for accessibility requirements.

(2) Security

Chapter 310 includes a general discussion of the United States Coast Guard (USCG) three-tiered system of Maritime Security (MARSEC) levels, vessels security requirements, and additional information pertaining to terminal design. Below are links to relevant sections by topic. Coordinate with the WSF Company Security Officer (CSO) regarding design issues pertaining to

security. In addition, coordinate with the USCG and Maritime Security for all terminals, the United States Customs and Border Protection (USCBP) for international terminals, and the Transportation Security Administration (TSA) for TWIC and SSI.

- MARSEC Levels: 310.04
- Signage: 310.13

(3) Environmental

Refer to Chapter 320 for general environmental requirements and design guidance. Refer to the project NEPA/SEPA documentation for project-specific environmental impacts and mitigation.

(4) Civil

Refer to Chapter 340 for general civil design criteria pertaining to toll plazas. Below are links to relevant sections by topic.

- Channelization: 340.07(1)
- Design Vehicle: 340.07(6)
- AutoTURN Analyses: 340.07(7)
- Paving: 340.08
- Traffic Control: 340.09

(5) Operations and Maintenance

Consult with WSF Operations and Terminal Engineering Maintenance throughout the design process and provide opportunities for their review of the project drawings and specifications. Consider the following operations and maintenance issues when designing the toll plaza:

- Minimize repair and maintenance required during the design life.
- Standardize toll booth design between terminals to the extent feasible (refer to current toll booth WSF reference design drawings).

(6) Toll Booth Ergonomics

There are numerous toll booth design considerations related to ergonomics issues and reducing the potential for related workers' compensation claims. These include, but are not limited to, counter heights, height of seller's window relative to traffic lane, and distance of seller from driver's window. Refer to WSF reference design drawings for current WSF toll booth design drawings which address known ergonomic issues associated with toll booths.

(7) Worker Safety

Consider the safety of toll booth attendants in the toll booth design and layout. Proper design of impact attenuators, toll booth approach zones, posted and design speeds, lane widths, toll booth ergonomics, toll booth access by employees, and visibility of oncoming traffic are all important to worker safety. These items are discussed throughout this chapter and incorporated in the toll booth layouts located on the WSF reference design drawings.

(8) Fare Collection Auditing

Consider the capability for fare collection auditing in the toll booth design including visibility of cash sales. WSF currently utilizes fare auditing cameras above each seller to monitor ticket sales. The cameras are activated by traffic loops as discussed in Section 510.04(2).

510.04 Toll Plaza Elements

(1) Approach Zone and Queue Area

For WSF purposes, the toll plaza is divided into distinct zones/areas. The first zone, the approach zone, typically begins where the roadway divides into one-directional flow. The following area, the queue area, is located after the approach zone and separates vehicles into separate selling lanes. The approach zone and the queue area are both located in advance of the third area, the toll booths. The fourth zone is the departure zone downstream of the toll booths.

Provide a minimum approach zone lane width of 11 feet and a maximum width of 12 feet. For approach zone lanes located on a curve, as shown in Exhibit 510-2, refer to Section 1240.04 of the WSDOT *Design Manual* for turning roadways widths.

Base the queue zone length on the estimated peak hour queue for the design year traffic volume. Where feasible, provide 80 feet of straight roadway in the queue area. Consider providing an additional 2 feet of roadway width between lanes in the queue area for future implementation of automated vehicle measuring systems. Most ferry operators using automated technology are placing detection and cameras between the toll lanes rather than overhead. See Section 510.06(1) for additional information.

Provide a transition area between the queue area and the toll booths where the roadway tapers to the width of the toll lanes at a calculated taper rate. Base the taper rate on an approach design speed of 20 mph and the available right-of-way and space. The FHWA recommends a minimum taper of 10:1 for speeds less than 30 mph in *State of the Practice and Recommendations of Traffic Control Strategies at Toll Plazas*. This taper rate is typically applied to highway or expressway toll plazas and may be increased for WSF applications in order to encourage drivers to drive at lower speeds when approaching the toll booths. Refer to Chapter 340 for roadway design and channelization, paving, and traffic control requirements.

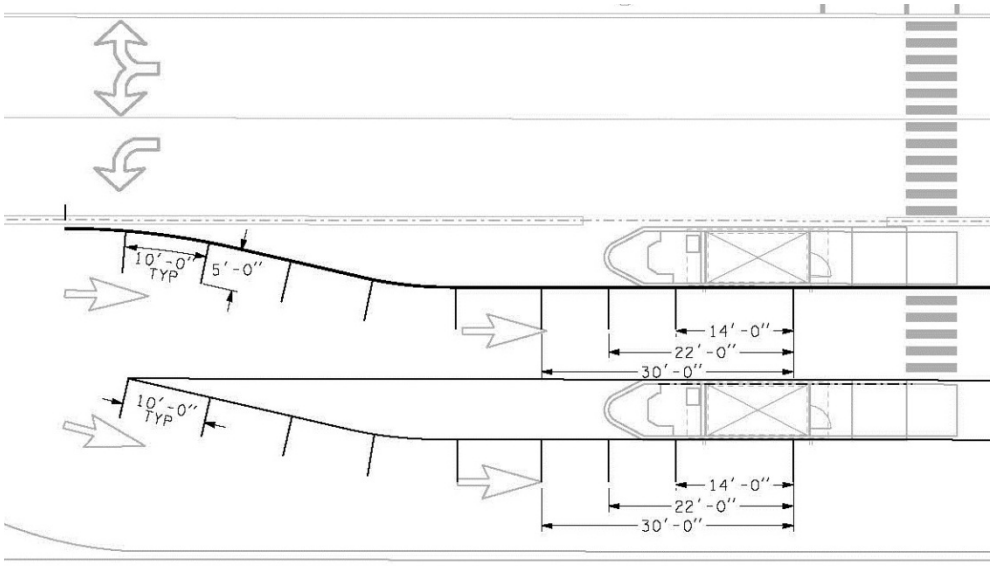
(2) Toll Lanes

Design the lanes between the toll booths, the toll lanes, to a minimum width of 11 feet and a maximum width of 12 feet. Where toll lanes exceed 11 feet in width, provide raised pavement markers in order to emulate 11-foot lane widths. The markers are to discourage drivers from stopping their vehicles too far from the toll window while still allowing larger vehicles to use the lane. Toll lane widths of less than 11 feet will require a design deviation.

Vehicle measurements, including vehicle length and height, are collected at the toll booths to determine fares and vehicle placement in the holding lanes and on the vessel. Provide plastic tariff markers, WSDOT Standard Specification 9-34.3(1) Type A – Liquid Hot Applied Thermoplastic, extending back from the sellers window to measure vehicle length. Plastic markers are preferred over paint because they require less maintenance. The markers are to be placed in the pavement during construction of the toll lanes. Provide markers to determine vehicle lengths within the following ranges (see Exhibit 510-3):

- 0 to under 14 feet

- 14 to under 22 feet
- 22 to under 30 feet
- From 30 feet to 80 feet (provide markers at 10 foot intervals)



WSF Toll Booth Tariff Line Striping

Exhibit 510-3

Locate a flexible flag in each toll lane to measure oversized vehicles. Mount the flag at a height of 7'-6". Do not provide truck scales in the toll lanes. Actual vehicle weight is not measured. The stenciled weight on the truck is checked to ensure the vehicle is under 80,000 pounds.

Provide a 31.5-foot long concrete vehicle pad for the toll lanes. Concrete provides a solid foundation for the toll booths and toll booth equipment. Concrete pavement resists rutting. Design the foundation to be above the roadway to divert drainage away from the toll booths.

Provide fare auditing cameras above each seller and place two loop detectors per toll booth. The first loop detector turns on the camera and the second loop detector turns off the camera. Refer to Exhibit 510-4 for loop detector locations within the concrete vehicle pad area.

(3) Design/Posted Speed

Use a design speed of 20 mph for the toll plaza. The posted speed is to be less than or equal to the design speed. If specific site constraints exist which warrant a design/posted speed of less than 20 miles per hour, a sight speed study must be performed to justify the lower speed.

(4) Shy Distance/ Clear Zone

The clear zone is the area between the edge of the traveled way and any obstruction. Design the clear zone in the toll plaza area to be a minimum of 2 feet. This distance can be reduced to a 1-foot minimum where warranted by site constraints.

(5) Toll Booths

Arrange the toll booths in line with the lanes of the queue area in the approach zone. Locate toll booths such that motorists are able to see the booths, while driving at posted speed limits with adequate stopping sight distance before the queue zone.

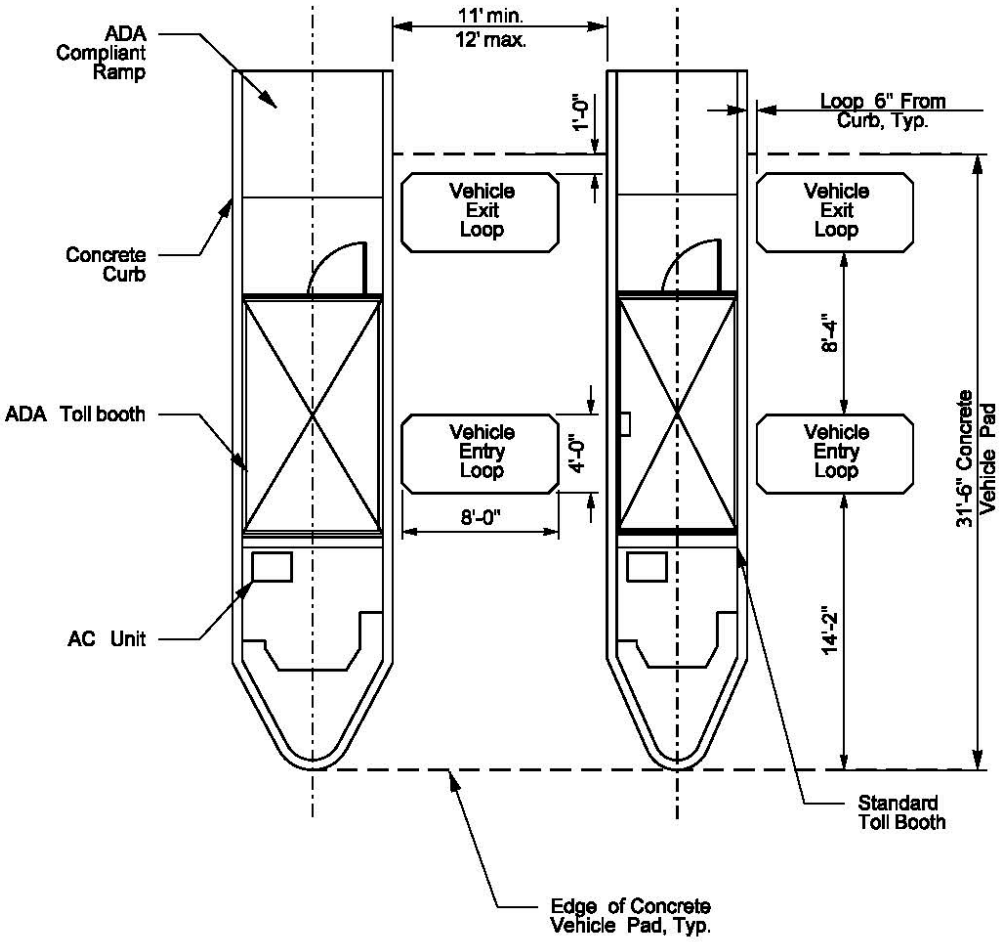
(a) Employee Work Space

Toll booths are employee work spaces. If toll booths are 200 feet or more from the terminal building, consider providing an employee restroom and restroom cleaning supply storage area.

(b) Standard and ADA Toll Booth Design

To the extent feasible, base all new toll booth design on WSF's current toll booth design, available on the WSF *Reference Drawings*. Exhibit 510-4 gives a schematic representation of the preferred layout for both standard and ADA toll booths. Minor toll booth design modifications may be required from project to project. For toll booth structural, mechanical and electrical requirements, refer to Chapter 350 (Buildings), and Chapter 360 (Electrical).

Unlike WSDOT Standard Plans, the drawings provided on the WSF *Reference Drawings* are intended for reference only and are not pre-approved, stamped engineering drawings. The final toll booth design drawings must be stamped by licensed engineers/architects, as required by state law.



WSF Toll Booth Layout

Exhibit 510-4

(c) Toll Booth Equipment

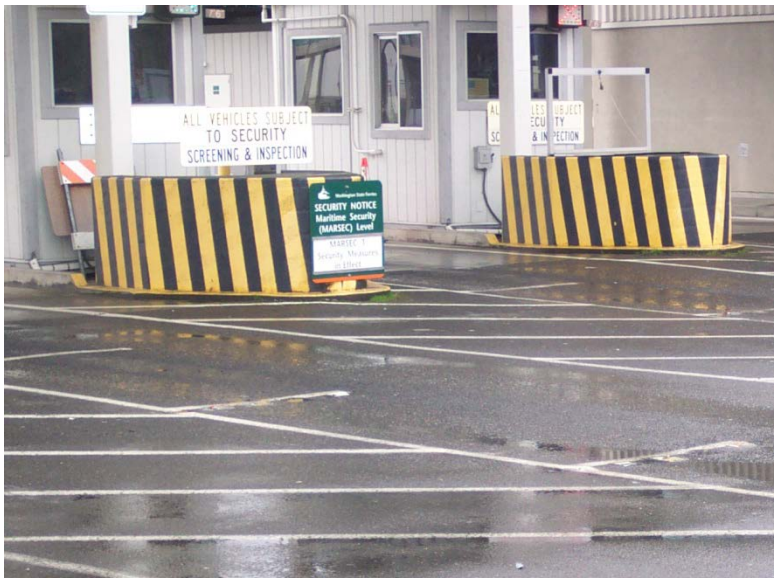
Outfit each toll booth with the following equipment:

- Electronic fare system and point of sale device
- Seller drop safe
- Phone/intercom /PA system
- Emergency and terminal radio communications
- Lane/sign control panel
- Electrical access panel
- Heat pump AC unit

(d) Toll Booth Layout

Layout each toll booth to allow for the following:

- Equipment counter and cabinetry
- Triple slider sellers window and window blinds
- Concrete curb encompassing exterior of toll booth
- Concrete vehicle barrier located at front of toll booth structure



Seattle Ferry Terminal Concrete Barrier
Exhibit 510-5

(6) Canopy

Provide a canopy over the toll booths. Canopies shield patrons and toll attendants from the elements, serve as a mounting frame for signs, lighting, and lane signals, define the location of the toll lane for motorists and provide a chase for toll lane computer, communications, and power cables. Comply with minimum vertical clearance requirements under the signage of 16 feet with a preferred clearance of 16.5 feet.

When designing the size and shape of the canopy consider the angle of wind-driven precipitation, the sun's path, general aesthetics, and the terminal architectural requirements. The canopy also may be sloped following the cross slope of the toll plaza for aesthetic reasons and to facilitate drainage.

(7) Departure Zone

Provide an area between the toll booth and the vehicle holding area known as the departure zone. Note that it is common for a terminal to provide a greater number of vehicle holding lanes than toll booths. Therefore, unlike in highways where the departure zone allows traffic to merge back into the highway lanes, the ferries departure zone allows traffic to diverge into the vehicle holding

lanes. Similar to the approach zone, calculate a taper for the departure zone based on a design speed of 20 mph and the available right-of-way and space.

(8) Bail-out Lane

Provide a vehicle bail-out lane after the toll booths and prior to the vehicle holding area for customers to choose to exit the terminal without boarding a ferry.

Consider providing a bail-out gate for revenue control and/or to prevent unauthorized access into the ferry terminal. If the gate is to be operable by the toll booth operator, it must be located in a position visible to the operator, or other provisions made.

Seattle Ferry Terminal Toll Booths, Canopy, and Departure Zone
Exhibit 510-6

510.05 Determining Number of Toll Booths

As previously noted not all terminals have toll booths. Refer to Appendix P for the number of toll booths at existing terminals.

Where vehicle tolls are collected, calculate the minimum number of toll booths required based on both the rate at which vehicles are processed through the toll booth and the rate at which they must load onto a vessel to maintain the ferry schedule.

(a) Toll Booth Processing Rates

Historically, WSF has used an average vehicle processing rate of 2.5 vehicles per minute per toll booth. This calculates to a rate of 150 vehicles per hour per toll booth (vphpt). This rate was based on WSF operational experience, the accepted payment methods at the time, and required fare determination activities (counting passengers, determining age of passengers, measuring vehicle length and height of large vehicles, checking HOV passes).

Current toll booth processing data indicates that it is possible to process up to 180 vphpt; however, actual rates vary between terminals and throughout the day. The actual processing rate is dependent on a number of variables which include: rate for processing through the reservation

system (both the existing manual check-in system and a future upgraded check-in system); use of credit cards and Smart Cards; down time between shifts; and holding lane capacity.

(b) Planning Level Toll Booth Calculation

Use the following calculation as a general planning level tool for calculating the number of toll booths required at a given terminal to meet the peak service schedule anticipated for the design year. Make adjustments to the calculated value based on the terminal-specific considerations discussed in Section 510.05(c) below and input from WSF Operations staff.

1. Rate of vehicle transaction (R)

$$R = 150 \quad \frac{(\frac{vehicles}{hour})}{tollbooth}$$

2. Determine the published vehicles per full ferry (V)[1].

$$V \quad \frac{vehicles}{ferry}$$

Note: If there is more than one vessel scheduled to moor at the slip, use the largest vehicle capacity as V.

3. Determine the boat service schedule at the terminal (B).

$$B \quad \frac{ferries}{hour}$$

Note: This value should be based on the peak service schedule anticipated for the design year and should be consistent with the *Long Range Plan*.

4. Calculate the number of vehicles per hour leaving the holding area (N).

$$(V\ \frac{vehicles}{ferry}) \times (B\ \frac{ferries}{hour}) = (N\ \frac{vehicles}{hour})$$

Note: For terminals serving multiple destinations, calculate a separate value of N for each slip, based on a common design hour, and add the N values together for use in Step 5. The design hour is the 60-minute consecutive period that has the greatest total vehicle capacity on all sailings scheduled to depart within that hour.

5. Calculate the number of toll booths (T).

$$(N\ \frac{vehicles}{hour}) / (R\ \frac{(\frac{vehicles}{hour})}{tollbooth}) = T\ toll\ booths$$

Note: Use R=150 vphpt as a starting point. Round up the calculated number of toll booths to the nearest whole number to determine the required number of toll booths (i.e. a calculated number of toll booths equal to 2.4 would result in 3 toll booths required). It may be possible to round this number down based on the terminal-specific considerations/adjustments noted below.

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[1] For terminals serving the San Juan Island (Anacortes, Lopez, Shaw, Orcas and Friday Harbor), where one vessel serves multiple destinations, each terminal has an allotment of vehicle spaces on the vessel. For such terminals, use a value for V equal to the maximum vehicle allotment rather than the full ferry capacity. The allotment of vehicles for these terminals can be obtained from the Service Manager in the WSF Planning Department.

(c) Terminal-Specific Toll Booth Calculation Adjustments

Adjust the number of toll booths calculated in Section 510.05(b) above, as required, based on the following considerations and any other applicable site-specific conditions.

- Modify the rate of vehicle transaction (R) based on the actual measured processing rate at the terminal, adjusted for anticipated payment methods, fare determination activities, and existing technology in the design year.
- Consider the arrival rate of customers. The calculation above assumes relatively steady processing of the vehicles over the design hour. At terminals with a high percentage of commuters, there is a tendency for the majority of the customers to arrive about 10 minutes prior to sailing, resulting in the need for a higher processing rate in the last 10 minutes (assuming the ferry is to sail full). Adjust the value of (R) to reflect the average processing rate over the entire design hour. Consider performing a Business Case Analysis to determine the cost benefit of employing additional toll booth staff to process customers unwilling to arrive sufficiently early verses allowing the ferry to sail without being completely full when there are customers waiting in line.
- Adjust the published vehicle ferry capacity (V) based on a current vehicle count study. Published vehicle capacity data for the vessels may vary from actual numbers depending on the vehicle distribution (e.g. number of cars verses trucks, average lengths of cars, etc.).

510.06 Operational Strategies

This section describes operating strategies that WSF is currently researching to improve toll plaza efficiency. Coordinate with the WSF Operations Liaison to determine whether or not these strategies will be used during the project.

(1) Vehicle Metric Scanning

The installation of Vehicle Metric Scanning equipment at the approaches to the vehicle toll booths is being studied as a future fare collection technology. Vehicle Metric Scanning equipment will measure the height, width and length of each vehicle. This information will be used to classify the vehicle within a category for fare determination and will be used as input to the Load Management System.

(2) Load Management System

One of the reasons for a Load Management system is to determine what space is available for a specific sailing at the time the vehicle fare is collected. With a vision for fully automated self-service capability, this information will be needed in order to tell the customer/driver which lane to stage in once they leave the toll booth. In a fully automated system, the system will communicate this information on an interactive screen as well as printing on a receipt the sailing and staging lane number.

(3) Good to Go Transponders

WSF is looking into the use of license plate recognition cameras and software at the toll booths. This approach is similar to the WSDOT approach to tolling on SR 520.

(4) High-occupancy Toll (HOT) Lanes

HOT lanes are a hybrid system that combines voluntary congestion pricing and reservations. This strategy would require a creation of high-occupancy vehicle (HOV) lanes—such as those on freeways—at ferry terminals that would give priority to vehicles willing to pay a toll for assured passage on the next ferry. The lanes could also give priority to high-occupancy vehicles, such as its freeway counterpart does, or other sub-groups of vehicles deemed appropriate.

(5) Electronic Fare Collection (EFS)

Operational strategies pertaining to ticketing, such as eTicketing and fare structure simplification, are designed to reduce customer processing time and improve efficiencies at the terminal docks prior to departure. WSF has recently completed the roll out of a new electronic fare collection system (EFS), which would allow passengers to purchase future tickets, but not specific trips, online and via kiosks and some toll booths.

(6) Vehicle Reservation System

As described in the *Long Range Plan*, WSF is planning the implementation of a vehicle reservation system, which would allow customers to reserve space on a specific vessel sailing in advance. The customers would reserve a travel slot at the time of their choice through an Internet-hosted computer system, over the phone, or at walk-up kiosks. As stated in the *Long Range Plan*, "A well-designed reservation system would allow WSF to operate with the smallest possible terminal facilities while maintaining a high level of service."

A predesign study summarizing the potential results of the vehicle reservation system has been completed by WSF. This study is available for download from the WSF website.

510.07 Toll Plaza Signage

Provide electronic reader boards on the front of the toll booths with variable message indicating toll booth status. Toll booths may be identified as open, closed or for priority vehicle use only. Provide sign bridges/variable message signs with public information, lane assignments and sailing status information prior to the toll booths and/or within the holding area as needed. Refer to Chapter 770 for additional signage requirements.